CIGARETTE LIGHTER CHARGER LCH–2

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

Cigarette Lighter Charger LCH–2

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Cigarette Lighter Charger LCH–2

Related Documentation

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6E	0260094	assembly parts LCH–2U

General

The LCH–2 cigarette lighter charger is used for charging the battery of the handportable phone from the 12 or 24 V cigarette lighter socket of a motor vehicle. The charger is provided with LED charging indication.

Technical Summary

States of Charge and Charge Control

The LCH–2 cigarette lighter charger is used for charging a handportable phone from a car battery. A constant–current or constant–voltage output is provided depending on the operating state of the phone.

Charge current is supplied through a series switch transistor located in the phone. When the transistor is on the charger supplies a constant current to the phone. The phone is then in the rapid charge mode.

When the transistor is off no current is supplied to the phone and the charger is in the constant–voltage mode.

Once fully charged in the rapid charge mode, the battery is kept full by means of pulsed charging. Current is switched on and off at a variable duty cycle and a frequency of a few Hz.

Charge Indication

Charger states are indicated with a dual–colour LED located in the cigarette lighter charger unit.

In addition, the phone LCD contains a three–bar battery status display, operative when power for the phone is on.

”Charging sequence active” (state A) is indicated by the bars being lit sequentially, starting from the bottom one.

”Battery full” (state B) is indicated by all three bars steadily lit.

Phone operating status	LED	Display
Cigarette lighter charger connected to vechile, phone disconnected	green	
Phone connected to charger, charging disabled due to battery temperature	green	state A
Rapid charge	red	state A
Battery full –> trickle charge	green	state B
Calling state	green/ red *)	state A

**) Battery capacity is maintained during a phone call by occasional rapid charge cycles. Consequently, the LED can be indicating either red or green.*

Electrical Specifications

Operating input voltage:	9 to 32 V d.c.
Input current without phone:	< 60 mA
Max. input current:	1.8 A
Output voltage:	
• constant voltage	12.5 ±1 V/0...400 mA
• constant current	800 ±70 mA/5.0...10 V

Functional Description

General

The charger module consists of a switched–mode converter and a bicolour indicator LED. The converter is of the step up/down type, i.e. the output voltage can be lower or higher than the input voltage.

Converter

Converter input current is received via filter capacitor C101. The converter consists of coils L110, L112, FET switch V112, d.c. level shifting capacitor C111 and Schottky diode V113. Output energy is stored and filtered by C112, L111 and C113.

In series with converter coil L112 is resistor R116, used for measuring the output current. When operating, the converter generates a negative voltage drop (as compared to ground level) at R116, directly proportional to output current.

Converter control is by N110, a quad comparator with open–collector output. The 5 V reference supply is generated by regulator N100.

Oscillator

The converter operates at a fixed frequency of 300 kHz, produced by oscillator N110A. A suitable operating voltage for the comparator positive input is set by resistor divider R112/R114. Positive feedback from the comparator output is supplied by R111 in parallel with C104. When the comparator output is high C110 is charged through R110 and R113 until the voltage at the negative input exceeds the positive input. At that instant the comparator output turns low and C110 is discharged via R113.

Pulse–Width Control

Pulse width is controlled by comparator N110B, where the sawtooth voltage from the oscillator is compared to a d.c. control voltage. Max. control voltage is set by resistor divider R121/R120 to make sure that pulse width cannot reach 100 % under any conditions as this would mean short–circuiting VB to GND via V112.

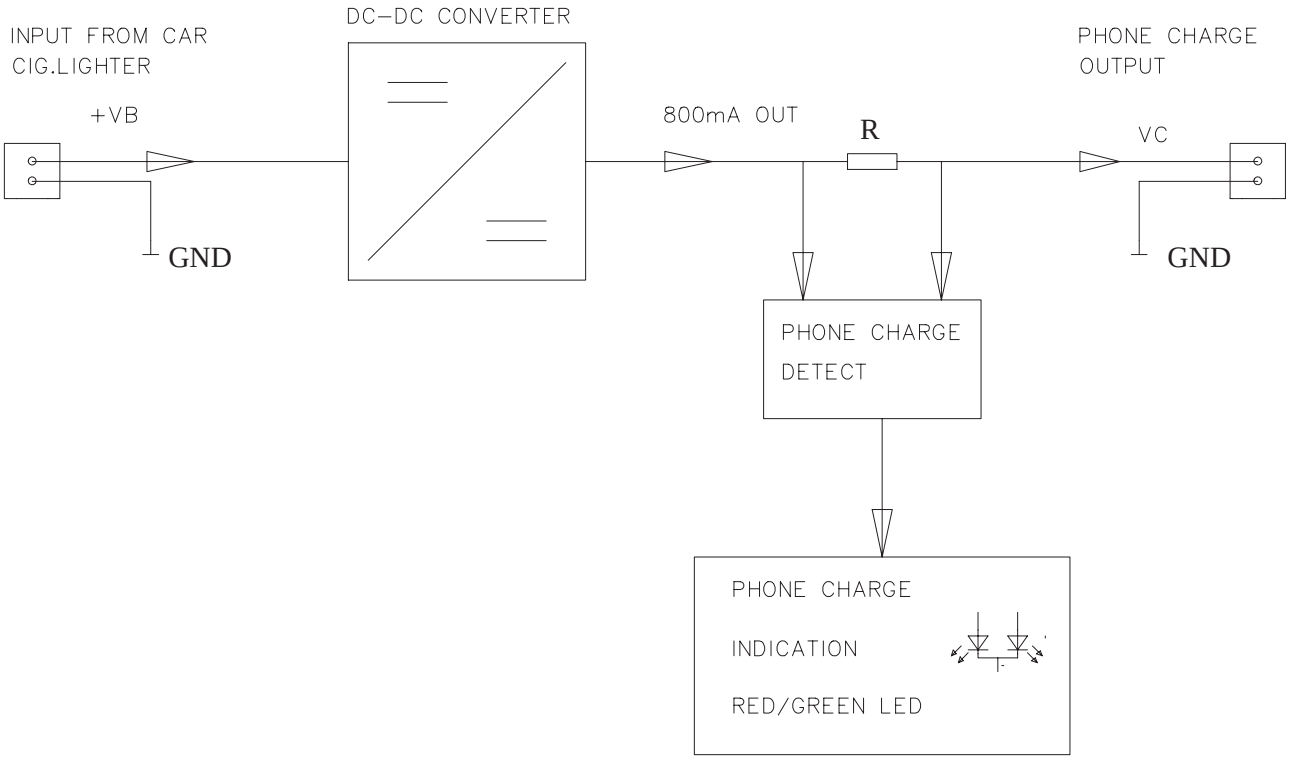
When the control voltage drops, so do the pulse width and the converter output current. The control voltage can be pulled down by output current comparator N110C, output voltage comparator N110D, or by the ”error” output pin of a reference regulator N100.

Current Limiting

Output current is measured with series resistor R116 connected between L112 and GND. When the converter operates with the output loaded it generates a negative voltage drop (as compared to GND) over this resistor.

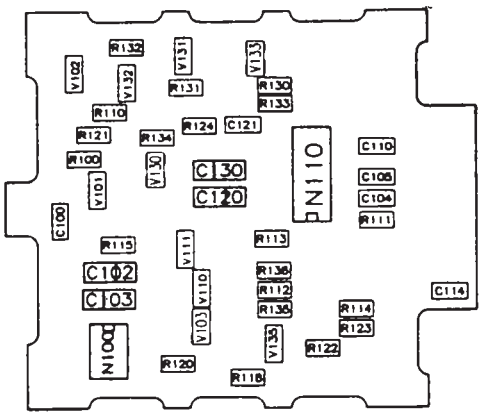
The voltage drop is added to the positive reference value set by R122 and R123 and used as the current comparator positive input. The current comparator compares the level of this input to zero (ground) level. When the current reaches the limit, voltage at the positive input falls to zero and the comparator output goes down, limiting the duty cycle. The value of the current limit is set by resistor divider R122, R123. A negative feedback for stabilize the comparator is produced with R124.

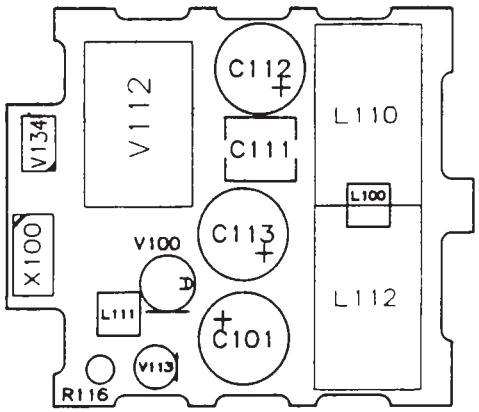
Block Diagram of AL4

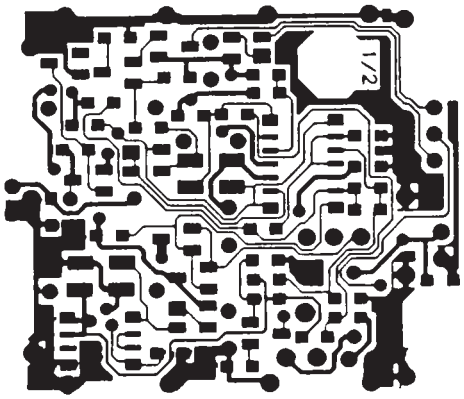


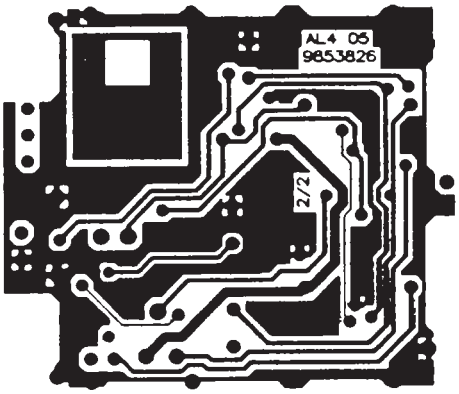
Circuit Diagram of AL4

Layout and Foil Diagrams of AL4









Parts List of AL4

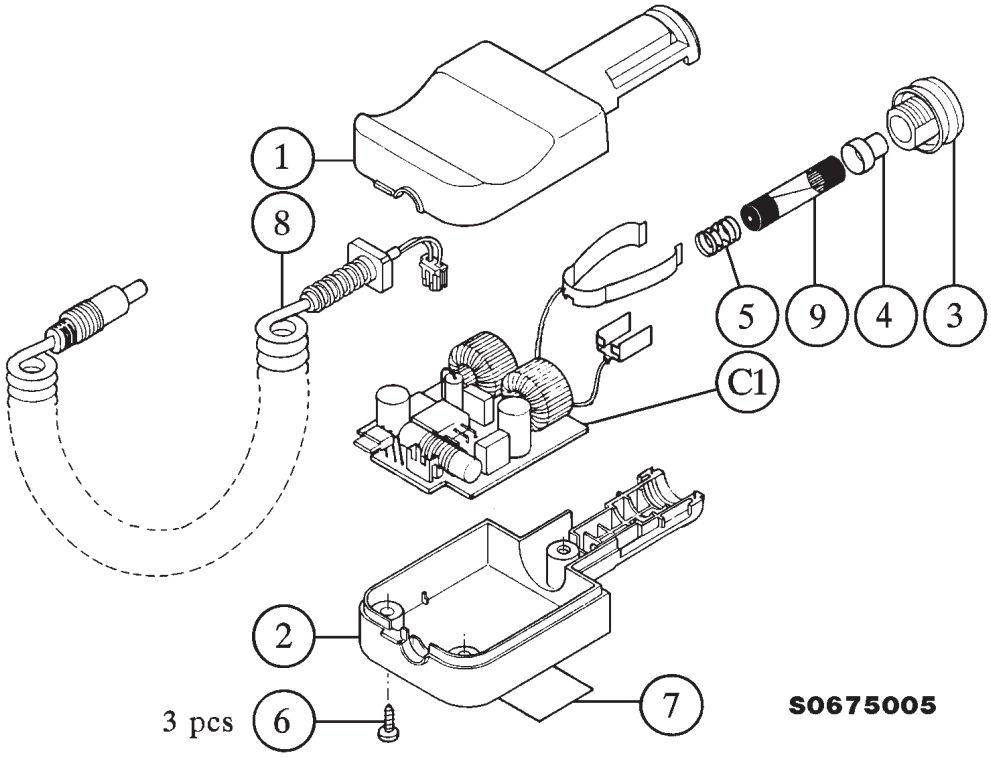
Code: 0200315

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R100	1413603	Chip resistor	47 k	5 % 0.063 W 0805
R106	1412286	Jumper		0805
R117	1413829	Chip resistor	10	5 % 0.063 W 0805
R130	1413603	Chip resistor	47 k	5 % 0.063 W 0805
R131	1412310	Chip resistor	470	5 % 0.063 W 0805
R132	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R133	1412310	Chip resistor	470	5 % 0.063 W 0805
R134	1410419	Melf resistor	47	5 % 2 W 5.2x17.9
R135	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R136	1413603	Chip resistor	47 k	5 % 0.063 W 0805
R138	1413723	Chip resistor	470 k	5 % 0.063 W 0805
R140	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R141	1414533	Chip resistor	56 k	1 % 0.063 W 0805
R142	1413723	Chip resistor	470 k	5 % 0.063 W 0805
R143	1414526	Chip resistor	120 k	1 % 0.063 W 0805
R144	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R145	1412609	Chip resistor	27 k	5 % 0.063 W 0805
R146	1413723	Chip resistor	470 k	5 % 0.063 W 0805
R147	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R148	1413723	Chip resistor	470 k	5 % 0.063 W 0805
R149	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R150	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R151	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R152	1413924	Chip resistor	220	5 % 0.063 W 0805
R153	1413924	Chip resistor	220	5 % 0.063 W 0805
R154	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R155	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R156	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R157	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R158	1413603	Chip resistor	47 k	5 % 0.063 W 0805
R160	1413603	Chip resistor	47 k	5 % 0.063 W 0805
R161	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R162	1413924	Chip resistor	220	5 % 0.063 W 0805
R163	1414244	Chip resistor	2.2 M	5 % 0.063 W 0805
R164	1414244	Chip resistor	2.2 M	5 % 0.063 W 0805
R170	1414533	Chip resistor	56 k	1 % 0.063 W 0805
R171	1414477	Chip resistor	12.0 k	1 % 0.063 W 0805
R172	1413723	Chip resistor	470 k	5 % 0.063 W 0805
R180	1413603	Chip resistor	47 k	5 % 0.063 W 0805
R181	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R182	1412310	Chip resistor	470	5 % 0.063 W 0805
R183	1412310	Chip resistor	470	5 % 0.063 W 0805
C102	2604209	Tantalum cap.	1.0 µ	20 % 16 V 3.2x1.6x1.8

C103	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C104	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C114	2310777	Ceramic cap.	22 n	20 % 50 V 0805
C140	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C141	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C142	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C143	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C150	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C151	2310343	Ceramic cap.	22 p	5 % 50 V 0805
C152	2310343	Ceramic cap.	22 p	5 % 50 V 0805
C153	2604209	Tantalum cap.	1.0 µ	20 % 16 V 3.2x1.6x1.8
C154	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C155	2310738	Ceramic cap.	4.7 n	20 % 50 V 0805
C160	2307816	Ceramic cap.	47 n	20 % 25 V 0805
C161	2604209	Tantalum cap.	1.0 µ	20 % 16 V 3.2x1.6x1.8
C170	2307816	Ceramic cap.	47 n	20 % 25 V 0805
B150	4500685	Crystal	4.8000 M	CL30PF h=3.6 mm
V104	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V114	4100221	Schottky diode	21DQ06	60 V 1.7 A d=3.7x7 mm
V130	4210020	Transistor	BCP69–25	pnp 20 V SOT223
V131	4100221	Schottky diode	21DQ06	60 V 1.7 A d=3.7x7 mm
V132	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V134	4200226	Darl. transistor	BCV27	npn 30 V 300 mA SOT23
V140	4100567	Sch. diode x 2	BAS70–04	70 V 15 mA SERSOT23
V141	4106992	Zener diode	BZX84	5 % 8.2 V 0.3 W SOT23
V150	4102974	Led	Green/Red	2.1 V 2x5 mm
V151	4102974	Led	Green/Red	2.1 V 2x5 mm
V152	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V153	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V154	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V155	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V160	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V162	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V170	4100567	Sch. diode x 2	BAS70–04	70 V 15 mA SERSOT23
V180	4210020	Transistor	BCP69–25	pnp 20 V SOT223
V181	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
D150	4340068	IC, ROM	MCU16/8	QFP64
N100	4301062	IC, regulator	LP2951AC	SO8S
N140	4309576	IC, 2 x op.amp.	TLC27M2I	SO8
S130	5200116	Bush button switch 1–lock 1–pole		
X110	9510041	Ph.conn.spring		4D21402 DCH–2
X111	9510041	Ph.conn.spring		4D21402 DCH–2
X120	9510040	Bat.conn.spring		4D21401 DCH–2
X121	9510040	Bat.conn.spring		4D21401 DCH–2
X122	9510040	Bat.conn.spring		4D21401 DCH–2
X123	9510040	Bat.conn.spring		4D21401 DCH–2
X130	5407088	DC connector d=4.5/3.8		

9460032	Led holder		3D21400 DCH–2
9853825	PC board	AD4A	70x103x1.6 d 2/pa

Exploded View



Assembly Parts

ITEM	Q'TY	CODE	DESCRIPTION	VALUE, TYPE
1		9450050	Cover	1D 21289
2		9450051	Bottom	1D 21288
3		9450052	Head–screw	3D 21287
4		9500005	Head–pin	4D 21390
5		6400056	Connector spring	4D 21391
6	3	6154430	PT–screw	25 x 8 WN–1442
7		9370095	Type label	4D 21487
8		7100408	Spiral cable	3D 21247
9		5112050	Fuse 3.15 A/250 V	6.3 x 32 mm
C1		0200044	AL4 module	

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